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# PATENT OF INVENTION

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## Piston of light metal for internal combustion engines

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This invention relates to a piston of a light metal or alloy for internal combustion engines having a head surface covered by a protective plate of heat-resistant material and a cavity formed in the annular zone of the piston body to receive a cooling medium which may either be wholly enclosed in this cavity (cooling by oscillation effect) or pass through narrow orifices formed in the wall oriented towards the mouth of the piston body so as to enter and leave it (cooling by circulation).

Provision of such a cavity receiving a cooling medium in the part of the piston body which is contiguous with the heat-resistant protective plate is necessary in many cases. This is because, in the absence of said cavity, local overheating could arise which could cause destruction of the piston. But the provision and sealing of cavities of this type creates considerable difficulties during manufacture. When the pistons in question exhibit cooling by circulation, it has in practice hitherto been possible to provide such a cavity only by using sand cores, which makes it difficult, after casting of the metal, to remove the sand located in the narrow orifices intended for passage of the cooling medium. The manufacture of piston bodies as one-piece castings with cavities of the stated type by shell casting or die-casting is impossible. Moreover, it was reckoned hitherto that two-part pistons could not be used, because it was assumed that, under the hard working conditions to which an internal combustion engine piston is subjected, it was impracticable to achieve effective sealing of the contiguous walls of the two piston elements with a view to preventing passage of the cooling medium contained in the cavity. As far as pistons with cooling by oscillation effect are concerned, technical conditions are even less favourable.

The in-depth research which has resulted in the present invention has revealed that it is possible, despite the above prejudices and even in the case of two-part pistons, to achieve perfect tightness, which is long-lasting in operation, of the piston cooling cavity provided that a flush-mounted annular plug provided with a projecting portion, advantageously provided with a narrowed portion, is used to close off the upper part of said cavity, that is to say the part thereof positioned beneath the protective plate. This plug may have dimensions such that the shells or punching dies

required to obtain the cavity may easily be introduced through the orifice provided for this purpose in the piston body.

The plate protecting the piston head is conveniently arranged in such a way that, between it and the piston body, there remains a slit forming a simple air space or stuffed with a thermally insulating packing, and that said plate bears via a narrow annular shoulder against the plug closing the cavity. The flow of heat between the head protecting plate and piston body is, in fact, impeded while simultaneously better ensuring the exact position of the closing cover.

The attached drawing shows, by way of example, a possible embodiment of the invention as applied to a piston with flow cooling.

Fig. 1, which constitutes the left-hand part of said drawing, is a longitudinal sectional view of the piston taken at the level of the connecting rod big end pin.

Fig. 2, which constitutes the right-hand part, is a sectional view taken perpendicularly to Fig. 1.

In the body 1 of the piston which is intended to be made of a light metal or alloy, there is formed, above the bosses receiving the connecting rod big end pin (not shown), an annular cavity 2 sealed hermetically at its upper part by a flush-mounted plug 3 exhibiting a projecting portion. At this cavity 2 there terminate incoming channels 4 connected to the receptacle for the connecting rod big end pin and outgoing channels 5 connected to the internal volume of the piston. At its upper end, the piston is covered with a head protecting plate 6 fixed at its centre and consisting of a highly heat-resistant material. This plate 6 is mounted in such a way as to leave between it and the adjacent wall of the piston body 1 a gap 7 forming a thin layer of air. The protective plate 6 bears against the plug 3 only via a narrow shoulder 8.

During operation, when the piston descends, the oil passes, as a result of its inertia and the pressure stemming from the pin bearings, through the channels 4 and enters the cavity 2. This oil is splashed against the internal faces of the annular plug 3 and absorbs heat. When the piston rises again, the oil which has thus been heated is, on the other hand, splashed by inertia against the cooler, lower wall of the cavity 2 and exits again in part via the channels 5.

If a piston with cooling by oscillation effect has to be equipped according to the invention, the channels 4 and 5 are not provided. The cooling medium (for example a suitable salt), whose melting point is a little lower than the temperature which the piston head reaches during operation, is then introduced into the cavity 2 before the plug 3 is flush-mounted. Cooling of the piston head is then achieved in known manner in that, when the piston descends, the cooling medium is splashed as a result of its inertia against the plug 3, where it absorbs heat, while, when the piston rises again, the cooling medium is splashed against the closing wall of the cavity 2 and then gives up the heat which it has absorbed. The subsequent flow of the heat is obtained partly through the intermediary of the piston rings and the bearing surfaces of the piston skirt towards the cylinder and partly through the intermediary of the lower face of the closing wall of the cavity 2 towards the splashed oil which wipes the inside of the piston.

## SUMMARY STATEMENT:

1. A piston of light metal or alloy for internal combustion engines whose head surface is covered by a protective plate of heat-resistant material and whose annular zone is recessed to form a cavity serving to receive a cooling medium which may be

wholly enclosed in this cavity or may enter therein or exit therefrom through channels formed in the adjoining wall of the cavity oriented towards the mouth of the piston, characterised in that sealing of the upper part of said cavity is ensured by an annular plug, preferably flush-mounted, having an overhanging portion;

2. An embodiment of said piston, characterised in that the plate protecting the head of the piston bears against the plug closing the cavity containing the cooling medium only via a narrow annular shoulder.